Design Evidences in the Cosmos (1998)

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Adapted with updates from the author’s books,*The Fingerprint of God, second edition* (Promise, 1991), *The Creator and the Cosmos, second edition* (NavPress, 1995), and *Beyond the Cosmos* (NavPress, 1996). References may be found in these books and in the reference addendum at the end of this paper.

**Table 1: Evidence for the fine-tuning of the universe**

Over thirty parameters of the universe have been identified that must be carefully fixed in value for any kind of conceivable life (not just life as we know it) to exist at any time in the history of the universe. Some examples of these are given in Table 1.

1. strong nuclear force constant  
   if larger: no hydrogen; nuclei essential for life would be unstable  
   if smaller: no elements other than hydrogen
2. weak nuclear force constant  
   if larger: too much hydrogen converted to helium in big bang, hence too much heavy element material made by star burning; no expulsion of heavy elements from stars  
   if smaller: too little helium produced from big bang, hence too little heavy element material made by star burning; no expulsion of heavy elements from stars
3. gravitational force constant  
   if larger: stars would be too hot and would burn up quickly and unevenly|  
   if smaller: stars would be so cool that nuclear fusion would not ignite, thus no heavy element production
4. electromagnetic force constant  
   if larger: insufficient chemical bonding; elements more massive than boron would be unstable to fission  
   if smaller: insufficient chemical bonding
5. ratio of electromagnetic force constant to gravitational force constant  
   if larger: no stars less than 1.4 solar masses, hence short and uneven stellar burning  
   if smaller: no stars more than 0.8 solar masses, hence no heavy element production
6. ratio of electron to proton mass  
   if larger: insufficient chemical bonding  
   if smaller: insufficient chemical bonding
7. ratio of number of protons to number of electrons  
   if larger: electromagnetism dominates gravity preventing galaxy, star, and planet formation  
   if smaller: electromagnetism dominates gravity preventing galaxy, star, and planet formation
8. expansion rate of the universe  
   if larger: no galaxy formation  
   if smaller: universe collapses prior to star formation
9. entropy level of the universe  
   if larger: no star condensation within the proto-galaxies  
   if smaller: no proto-galaxy formation
10. mass density of the universe  
    if larger: too much deuterium from big bang, hence stars burn too rapidly  
    if smaller: insufficient helium from big bang, hence too few heavy elements forming
11. velocity of light  
    if larger: stars would be too luminous  
    if smaller: stars would not be luminous enough
12. age of the universe  
    if older: no solar-type stars in a stable burning phase in the right part of the galaxy  
    if younger: solar-type stars in a stable burning phase would not yet have formed
13. initial uniformity of radiation  
    if smoother: stars, star clusters, and galaxies would not have formed  
    if coarser: universe by now would be mostly black holes and empty space
14. average distance between galaxies  
    if larger: insufficient gas would be infused into our galaxy to sustain star formation for a long enough time  
    if smaller: the sun’s orbit would be too radically disturbed,
15. galaxy cluster type  
    if too rich: galaxy collisions and mergers would disrupt solar orbit  
    if too sparse: insufficient infusion of gas to sustain star formation for a long enough time
16. average distance between stars  
    if larger: heavy element density too thin for rocky planets to form  
    if smaller: planetary orbits would become destabilized
17. fine structure constant (a number used to describe the fine structure splitting of spectral lines)  
    if larger: no stars more than 0.7 solar masses  
    if smaller: no stars less than 1.8 solar masses  
    if larger than 0.06: matter is unstable in large magnetic fields
18. decay rate of the proton  
    if greater: life would be exterminated by the release of radiation  
    if smaller: insufficient matter in the universe for life
19. 12C to 16O nuclear energy level ratio  
    if larger: insufficient oxygen  
    if smaller: insufficient carbon
20. ground state energy level for 4He  
    if larger: insufficient carbon and oxygen  
    if smaller: insufficient carbon and oxygen
21. decay rate of 8Be  
    if slower: heavy element fusion would generate catastrophic explosions in all the stars  
    if faster: no element production beyond beryllium and, hence, no life chemistry possible
22. mass excess of the neutron over the proton  
    if greater: neutron decay would leave too few neutrons to form the heavy elements essential for life  
    if smaller: proton decay would cause all stars to rapidly collapse into neutron stars or black holes
23. initial excess of nucleons over anti-nucleons  
    if greater: too much radiation for planets to form  
    if smaller: not enough matter for galaxies or stars to form
24. polarity of the water molecule  
    if greater: heat of fusion and vaporization would be too great for life to exist  
    if smaller: heat of fusion and vaporization would be too small for life; liquid water would be too inferior of solvent for life chemistry to proceed; ice would not float, leading to a runaway freeze-up
25. supernovae eruptions  
    if too close: radiation would exterminate life on the planet  
    if too far: not enough heavy element ashes for the formation of rocky planets  
    if too infrequent: not enough heavy element ashes for the formation of rocky planets  
    if too frequent: life on the planet would be exterminated  
    if too soon: not enough heavy element ashes for the formation of rocky planets  
    if too late: life on the planet would be exterminated by radiation
26. white dwarf binaries  
    if too few: insufficient flourine produced for life chemistry to proceed  
    if too many: disruption of planetary orbits from stellar density; life on the planet would be exterminated  
    if too soon: not enough heavy elements made for efficient flourine production  
    if too late: flourine made too late for incorporation in protoplanet
27. ratio of the mass of exotic matter to ordinary matter  
    if smaller: galaxies would not form  
    if larger: universe would collapse before solar type stars can form
28. number of effective dimensions in the early universe  
    if smaller: quantum mechanics, gravity, and relativity could not coexist and life would be impossible  
    if larger: quantum mechanics, gravity, and relativity could not coexist and life would be impossible
29. number of effective dimensions in the present universe  
    if smaller: electron, planet, and star orbits would become unstable  
    if larger: electron, planet, and star orbits would become unstable
30. mass of the neutrino  
    if smaller: galaxy clusters, galaxies, and stars will not form  
    if larger: galaxy clusters and galaxies will be too dense
31. big bang ripples  
    if smaller: galaxies will not form; universe expands too rapidly  
    if larger: galaxies will be too dense; black holes will dominate; universe collapses too quickly
32. size of the relativistic dilation factor  
    if smaller: certain essential life chemistry reactions will not function properly  
    if larger: certain essential life chemistry reactions will not function properly
33. uncertainty magnitude in the Heisenberg uncertainty principle  
    if smaller: oxygen transport to body cells would be too small; certain life-essential elements would be unstable  
    if larger: oxygen transport to body cells would be too great; certain life-essential elements would be unstable
34. cosmological constant  
    if too large: universe will expand too quickly for solar type stars too form

**Table 2: Evidence for the fine-tuning of the galaxy-sun-earth-moon system for life support**

It is not just the universe that bears evidence for design. The sun and the earth also reveal such evidence. Some sample parameters sensitive for the support of life are listed in Table 2.

The following parameters of a planet, its moon, its star, and its galaxy must have values falling within narrowly defined ranges for life of any kind to exist. Characteristics #2 and #3 have been repeated from Table 4 since they apply to both the universe and the galaxy.

1. galaxy size  
   if too large: infusion of gas and stars would disturb sun’s orbit and ignite too many galactic eruptions.  
   if too small: insufficient infusion of gas to sustain star formation for long enough time.
2. galaxy type  
   if too elliptical: star formation would cease before sufficient heavy element build-up for life chemistry.  
   if too irregular: radiation exposure on occasion would be too severe and heavy elements for life chemistry would not be available.
3. galaxy location  
   if too close to a rich galaxy cluster: galaxy would be gravitationally disrupted  
   if too close to very large galaxy(ies): galaxy would be gravitationally disrupted.
4. supernovae eruptions  
   if too close: life on the planet would be exterminated by radiation  
   if too far: not enough heavy element ashes would exist for the formation of rocky planets.  
   if too infrequent: not enough heavy element ashes present for the formation of rocky planets.  
   if too frequent: life on the planet would be exterminated.  
   if too soon: not enough heavy element ashes would exist for the formation of rocky planets.  
   if too late: life on the planet would be exterminated by radiation.
5. white dwarf binaries  
   if too few: insufficient flourine would be produced for life chemistry to proceed.  
   if too many: planetary orbits disrupted by stellar density; life on planet would be exterminated.  
   if too soon: not enough heavy elements would be made for efficient flourine production.  
   if too late: flourine would be made too late for incorporation in protoplanet.
6. proximity of solar nebula to a supernova eruption  
   if farther: insufficient heavy elements for life would be absorbed.  
   if closer: nebula would be blown apart.
7. timing of solar nebula formation relative to supernova eruption  
   if earlier: nebula would be blown apart.  
   if later:: nebula would not absorb enough heavy elements.
8. parent star distance from center of galaxy  
   if farther: quantity of heavy elements would be insufficient to make rocky planets.  
   if closer: galactic radiation would be too great; stellar density would disturb planetary orbits
9. parent star distance from closest spiral arm  
   if farther: quantity of heavy elements would be insufficient to make rocky planets.  
   if closer: radiation from other stars would be too great; stellar density would disturb planetary orbits.
10. z-axis heights of star’s orbit  
    if too large: exposure to harmful radiation from galactic core would be too great.
11. number of stars in the planetary system  
    if more than one: tidal interactions would disrupt planetary orbits.  
    if less than one: heat produced would be insufficient for life.
12. parent star birth date  
    if more recent: star would not yet have reached stable burning phase; stellar system would contain too many heavy elements.  
    if less recent: stellar system would not contain enough heavy elements.
13. parent star age  
    if older: luminosity of star would change too quickly.  
    if younger: luminosity of star would change too quickly.
14. parent star mass  
    if greater: luminosity of star would change too quickly; star would burn too rapidly.  
    if less: luminosity of star would change too slowly; range of planet distances for life would be too narrow; tidal forces would disrupt the life planet’s rotational period; uv radiation would be inadequate for plants to make sugars and oxygen.
15. parent star metallicity  
    if too small: insufficient heavy elements for life chemistry would exist.  
    if too large: radioactivity would be too intense for life; life would be poisoned by heavy element concentrations.
16. parent star color  
    if redder: photosynthetic response would be insufficient.  
    if bluer: photosynthetic response would be insufficient.
17. H3+ production  
    if too small: simple molecules essential to planet formation and life chemistry will not form.  
    if too large: planets will form at wrong time and place for life.
18. parent star luminosity relative to speciation  
    if increases too soon: runaway green house effect would develop.  
    if increases too late: runaway glaciation would develop.
19. surface gravity (escape velocity)  
    if stronger: planet’s atmosphere would retain too much ammonia and methane.  
    if weaker: planet’s atmosphere would lose too much water.
20. distance from parent star  
    if farther: planet would be too cool for a stable water cycle.  
    if closer: planet would be too warm for a stable water cycle.
21. inclination of orbit  
    if too great: temperature differences on the planet would be too extreme.
22. orbital eccentricity  
    if too great: seasonal temperature differences would be too extreme.
23. axial tilt  
    if greater: surface temperature differences would be too great.  
    if less: surface temperature differences would be too great.
24. rate of change of axial tilt  
    if greater: climatic changes would be too extreme; surface temperature differences would become too extreme.
25. rotation period  
    if longer: diurnal temperature differences would be too great.  
    if shorter: atmospheric wind velocities would be too great.
26. rate of change in rotation period  
    if longer: surface temperature range necessary for life would not be sustained.  
    if shorter: surface temperature range necessary for life would not be sustained.
27. age  
    if too young: planet would rotate too rapidly.  
    if too old: planet would rotate too slowly.
28. magnetic field  
    if stronger: electromagnetic storms would be too severe.  
    if weaker: ozone shield would be inadequately protected from hard stellar and solar radiation.
29. thickness of crust  
    if thicker: too much oxygen would be transferred from the atmosphere to the crust.  
    if thinner: volcanic and tectonic activity would be too great.
30. albedo (ratio of reflected light to total amount falling on surface)  
    if greater: runaway glaciation would develop.  
    if less: runaway greenhouse effect would develop.
31. asteroidal and cometary collision rate  
    if greater: too many species would become extinct.  
    if less: crust would be too depleted of materials essential for life.
32. mass of body colliding with primordial earth  
    if smaller: Earth’s atmosphere would be too thick; moon would be too small.  
    if greater: Earth’s orbit and form would be too greatly disturbed.
33. timing of body colliding with primordial earth.  
    if earlier: Earth’s atmosphere would be too thick; moon would be too small.  
    if later: sun would be too luminous at epoch for advanced life.
34. oxygen to nitrogen ratio in atmosphere   
    if larger: advanced life functions would proceed too quickly.   
    if smaller: advanced life functions would proceed too slowly.
35. carbon dioxide level in atmosphere   
    if greater: runaway greenhouse effect would develop.   
    if less: plants would be unable to maintain efficient photosynthesis.
36. water vapor level in atmosphere   
    if greater: runaway greenhouse effect would develop.   
    if less: rainfall would be too meager for advanced life on the land.
37. atmospheric electric discharge rate   
    if greater: too much fire destruction would occur.   
    if less: too little nitrogen would be fixed in the atmosphere.
38. ozone level in atmosphere   
    if greater: surface temperatures would be too low.   
    if less: surface temperatures would be too high; there would be too much uv radiation at the surface.
39. oxygen quantity in atmosphere   
    if greater: plants and hydrocarbons would burn up too easily.   
    if less: advanced animals would have too little to breathe.
40. seismic activity   
    if greater: too many life-forms would be destroyed.   
    if less: nutrients on ocean floors from river runoff would not be recycled to continents through tectonics.
41. oceans-to-continents ratio   
    if greater: diversity and complexity of life-forms would be limited.   
    if smaller: diversity and complexity of life-forms would be limited.
42. rate of change in oceans-to-continents ratio   
    if smaller: advanced life will lack the needed land mass area.   
    if greater: advanced life would be destroyed by the radical changes.
43. global distribution of continents (for Earth)   
    if too much in the southern hemisphere: seasonal differences would be too severe for advanced life.
44. frequency and extent of ice ages   
    if smaller: insufficient fertile, wide, and well-watered valleys produced for diverse and advanced life forms; insufficient mineral concentrations occur for diverse and advanced life.  
    if greater: planet inevitably experiences runaway freezing.
45. soil mineralization   
    if too nutrient poor: diversity and complexity of life-forms would be limited.   
    if too nutrient rich: diversity and complexity of life-forms would be limited.
46. gravitational interaction with a moon   
    if greater: tidal effects on the oceans, atmosphere, and rotational period would be too severe.   
    if less: orbital obliquity changes would cause climatic instabilities; movement of nutrients and life from the oceans to the continents and vice versa would be insufficient; magnetic field would be too weak.
47. Jupiter distance   
    if greater: too many asteroid and comet collisions would occur on Earth.   
    if less: Earth’s orbit would become unstable.
48. Jupiter mass   
    if greater: Earth’s orbit would become unstable.  
    if less: too many asteroid and comet collisions would occur on Earth.
49. drift in major planet distances   
    if greater: Earth’s orbit would become unstable.   
    if less: too many asteroid and comet collisions would occur on Earth.
50. major planet eccentricities   
    if greater: orbit of life supportable planet would be pulled out of life support zone.
51. major planet orbital instabilities   
    if greater: orbit of life supportable planet would be pulled out of life support zone.
52. atmospheric pressure   
    if too small: liquid water will evaporate too easily and condense too infrequently.   
    if too large: liquid water will not evaporate easily enough for land life; insufficient sunlight reaches planetary surface; insufficient uv radiation reaches planetary surface.
53. atmospheric transparency   
    if smaller: insufficient range of wavelengths of solar radiation reaches planetary surface   
    if greater: too broad a range of wavelengths of solar radiation reaches planetary surface.
54. chlorine quantity in atmosphere   
    if smaller: erosion rates, acidity of rivers, lakes, and soils, and certain metabolic rates would be insufficient for most life forms.   
    if greater: erosion rates, acidity of rivers, lakes, and soils, and certain metabolic rates would be too high for most life forms.
55. iron quantity in oceans and soils   
    if smaller: quantity and diversity of life would be too limited for support of advanced life;   
    if very small, no life would be possible.   
    if larger: iron poisoning of at least advanced life would result.
56. tropospheric ozone quantity   
    if smaller: insufficient cleansing of biochemical smogs would result.   
    if larger: respiratory failure of advanced animals, reduced crop yields, and destruction of ozone-sensitive species would result.
57. stratospheric ozone quantity   
    if smaller: too much uv radiation reaches planet’s surface causing skin cancers and reduced plant growth.   
    if larger: too little uv radiation reaches planet’s surface causing reduced plant growth and insufficient vitamin production for animals.
58. mesospheric ozone quantity   
    if smaller: circulation and chemistry of mesospheric gases so disturbed as to upset relative abundances of life essential gases in lower atmosphere.  
    if greater: circulation and chemistry of mesospheric gases so disturbed as to upset relative abundances of life essential gases in lower atmosphere.
59. quantity and extent of forest and grass fires   
    if smaller: growth inhibitors in the soils would accumulate; soil nitrification would be insufficient; insufficient charcoal production for adequate soil water retention and absorption of certain growth inhibitors.  
    if greater: too many plant and animal life forms would be destroyed
60. quantity of soil sulfur   
    if smaller: plants will become deficient in certain proteins and die.   
    if larger: plants will die from sulfur toxins; acidity of water and soil will become too great for life; nitrogen cycles will be disturbed.
61. quantity of sulfur in the life planet’s core   
    if smaller: solid core formation begins too soon causing it to grow too rapidly —disrupts magnetic field.   
    if larger: sold inner core never forms—disrupts magnetic field.
62. quantity of sea salt aerosols   
    if smaller: insufficient cloud formation and thus inadequate water cycle; disrupts atmospheric temperature balances.  
    if larger: too much and too rapid cloud formation over the oceans disrupting the climate; disrupts atmospheric temperature balances.
63. volcanic activity   
    if lower: insufficient amounts of carbon dioxide and water vapor would be returned to the atmosphere; soil mineralization would become too degraded for life.  
    if higher: advanced life, at least, would be destroyed.
64. rate of decline in tectonic activity   
    if slower: advanced life can never survive on the planet.   
    if faster: advanced life can never survive on the planet.
65. rate of decline in volcanic activity   
    if slower: advanced life can never survive on the planet.   
    if faster: advanced life can never survive on the planet.
66. biomass to minicomet infall ratio  
    if smaller: greenhouse gases accumulate, triggering runaway surface temperature increase.  
    if larger: greenhouse gases decline, triggering a runaway freezing.

**Table 3: An Estimate of the Probability for Attaining the Necessary Parameters for Life Support**

|  |  |  |
| --- | --- | --- |
| **PARAM. NUM.** | **PARAMETER** | **PROBABILITY OF GALAXY, STAR, PLANET, PARAMETER OR MOON FALLING IN REQUIRED RANGE BY CHANCE (WITHOUT DIVINE DESIGN)** |
| 1 | galaxy size | 0.1 |
| 2 | galaxy type | 0.1 |
| 3 | galaxy location | 0.1 |
| 4 | star location relative to galactic center | 0.2 |
| 5 | star distance from closest spiral arm | 0.1 |
| 6 | z-axis extremes of star's orbit | 0.1 |
| 7 | proximity of solar nebula to a supernova eruption | 0.01 |
| 8 | timing of solar nebula formation relative to supernova eruption | 0.01 |
| 9 | number of stars in system | 0.2 |
| 10 | star birth date | 0.2 |
| 11 | star age | 0.4 |
| 12 | star metallicity | 0.05 |
| 13 | star orbital eccentricity | 0.1 |
| 14 | star's distance from galactic plane | 0.1 |
| 15 | star mass | 0.001 |
| 16 | star luminosity relative to speciation | 0.0001 |
| 17 | star color | 0.4 |
| 18 | H3+ production | 0.1 |
| 19 | supernovae rates & locations | 0.01 |
| 20 | white dwarf binary types, rates, & locations | 0.01 |
| 21 | planetary distance from star | 0.001 |
| 22 | inclination of planetary orbit | 0.5 |
| 23 | axis tilt of planet | 0.3 |
| 24 | rate of change of axial tilt | 0.01 |
| 25 | planetary rotation period | 0.1 |
| 26 | rate of change in planetary rotation period | 0.05 |
| 27 | planetary orbit eccentricity | 0.3 |
| 28 | surface gravity (escape velocity) | 0.001 |
| 29 | tidal force | 0.1 |
| 30 | magnetic field | 0.01 |
| 31 | albedo | 0.1 |
| 32 | density | 0.1 |
| 33 | thickness of crust | 0.01 |
| 34 | oceans-to-continents ratio | 0.2 |
| 35 | rate of change in oceans to continents ratio | 0.1 |
| 36 | global distribution of continents | 0.3 |
| 37 | frequency & extent of ice ages | 0.1 |
| 38 | asteroidal & cometary collision rate | 0.1 |
| 39 | change in asteroidal & cometary collision rates | 0.1 |
| 40 | mass of body colliding with primordial earth | 0.002 |
| 41 | timing of body colliding with primordial earth | 0.05 |
| 42 | rate of change in ast. & comet collision rate | 0.1 |
| 43 | position & mass of Jupiter relative to Earth | 0.01 |
| 44 | major planet eccentricities | 0.1 |
| 45 | major planet orbital instabilities | 0.1 |
| 46 | drift and rate of drift in major planet distances | 0.1 |
| 47 | atmospheric transparency | 0.01 |
| 48 | atmospheric pressure | 0.1 |
| 49 | atmospheric electric discharge rate | 0.1 |
| 50 | atmospheric temperature gradient | 0.01 |
| 51 | carbon dioxide level in atmosphere | 0.01 |
| 52 | oxygen quantity in atmosphere | 0.01 |
| 53 | chlorine quantity in atmosphere | 0.1 |
| 54 | iron quantity in oceans | 0.1 |
| 55 | tropospheric ozone quantity | 0.01 |
| 56 | stratospheric ozone quantity | 0.01 |
| 57 | mesospheric ozone quantity | 0.01 |
| 58 | water vapor level in atmosphere | 0.01 |
| 59 | oxygen to nitrogen ratio in atmosphere | 0.1 |
| 60 | quantity of greenhouse gases in atmosphere | 0.01 |
| 61 | quantity of forest & grass fires | 0.01 |
| 62 | quantity of sea salt aerosols | 0.1 |
| 63 | soil mineralization | 0.1 |
| 64 | quantity of decomposer bacteria in soil | 0.01 |
| 65 | quantity of mycorrhizal fungi in soil | 0.01 |
| 66 | quantity of nitrifying microbes in soil | 0.01 |
| 67 | quantity of soil sulfur | 0.1 |
| 68 | quantity of sulfur in the life planet's core | 0.1 |
| 69 | tectonic activity | 0.1 |
| 70 | rate of decline in tectonic activity | 0.1 |
| 71 | volcanic activity | 0.1 |
| 72 | rate of decline in volcanic activity | 0.1 |
| 73 | viscosity at Earth core boundaries | 0.01 |
| 74 | biomass to minicomet infall ratio | 0.01 |
| 75 | regularity of minicometary infall | 0.1 |

**Dependency Factors Estimate: 100,000,000,000.**

**Longevity Requirements Estimate: .00001**

**Probability for occurrence of all 75 parameters: approx. 10 -99**

**Maximum possible number of planets in universe: approx. 10 22**

**Much less than 1 chance in a hundred thousand trillion trillion trillion trillion trillion trillion exists that even one such planet would occur anywhere in the universe.**

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Subjects: Earth/Moon Design, Galaxy Design, Solar System Design, Universe Design

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Reasons to Believe emerged from my passion to research, develop, and proclaim the most powerful new reasons to believe in Christ as Creator, Lord, and Savior and to use those new reasons to reach people for Christ. [Read more about Dr. Hugh Ross.](http://www.reasons.org/about/who-we-are/hugh-ross)

